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AMENDMENTS TO THE SPECIFICATION

Please replace paragraph [0003] with the following amended paragraph:

[0003] Electromagnetic devices generally use a magnetic core made from laminated structures. Laminated cores are made by stacking thin ferrous sheets which are oriented parallel to the magnetic field to provide low reluctance. The sheets may be coated to provide insulation and prevent current from circulating between sheets. Such insulation results in a reduction in the eddy current loss. ~~. In addition, the application of laminated cores is limited by the need to carry magnetic flux in the plane of the sheet to avoid excessive eddy current losses.~~

Please replace paragraph [0004] with the following amended paragraph:

[0004] Some of the problems of utilizing laminated cores in electrical devices such as motors have been overcome by utilizing moldable soft magnetic composites. ~~While soft magnetic composites provide a high copper fill factor and can reduce or even eliminate the air column within the motor they suffer from a number of drawbacks related to high temperature performance.~~ It is therefore desirable to produce electromagnetic devices having high permeability and low core loss characteristics in a cost effective manner. It is additionally desirable to produce electromagnetic devices that can operate efficiently at elevated temperatures.

Please replace paragraph [0028] with the following amended paragraph:

[0028] Figure 20 shows and optical micrograph of fused glass and enamel wire bobbins compressed at 100 ksi (690 MPa) in a ~~3 mm~~ soft magnetic ~~flakes~~ composite material~~;~~.

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Please replace paragraph [0055] with the following amended paragraph:

[0055] As stated above, the insulation layer comprises a curable polymeric resin that is disposed upon the ground wall insulation layer in the form of a coating. The curable polymeric resin is one that is capable of withstanding elevated temperatures of about 100 to about 350°C during the course of operation of the electrical device. Further it is desirable for the curable polymeric resin to be able to withstand the pressures imposed upon the ~~SMC~~ soft magnetic composite during compaction without any rupture or damage. The curable polymeric resin coating is preferably one that comprises a reactive functionality that can undergo crosslinking upon the application of heat or radiation to the coating. Examples of such curable polymeric resins include styrene-butadienes, styrene-isoprenes, polybutadienes, polyisobutylenes, polyurethanes, silicones, fluorosilicones and other fluoropolymers, chlorosulfonates, butyls, neoprenes, nitriles, polyisoprenes, plasticized nylons, polyesters, polyvinyl ethers, polyvinyl acetates, polyisobutylenes, ethylene vinyl acetates, polyolefins, and polyvinyl chlorides, copolymer rubbers such as ethylene-propylene (EPR), ethylene- propylene-diene monomer (EPDM), styrene-isoprene-styrene (SIS), styrene- butadiene-styrene (SBS), nitrile-butadienes (NBR) and styrene-butadienes (SBR), blends such as ethylene propylene diene monomer (EPDM), EPR, or NBR, and mixtures, blends, and copolymers thereof.

Please replace paragraph [0058] with the following amended paragraph:

[0058] A preferred curable polymeric resin coating comprises epoxy-functionalized siloxane polymers. Preferred epoxy-functionalized siloxane polymers include b-(3,4-epoxycyclohexyl)ethyltrimethoxy silane, dialkylepoxysiloxy- chain-stopped polydialkyl-alkylepoxysiloxane copolymers (such as the materials sold as UV9315 and UV9400 by General Electric Silicones), and trialkylsiloxy- chain-stopped polydialkyl-alkylepoxysiloxane copolymers (such the material sold as UV9300 by General Electric Silicones), epoxy functional siloxane resin (such as the material sold as UV9430 by General Electric Silicones), blends of epoxy functional siloxane copolymers with vinyl and/or propenyl ethers. Another preferred curable polymeric resin coating is SILOX® CE77 commercially available from Nippon Pelnox Corporation.

Please replace paragraph [0064] with the following amended paragraph:

[0064] After the application of the insulation layer to the wires of the winding, the insulated winding is placed in a mold and covered with ~~iron flakes and compacted to form the~~ a soft magnetic ~~composite~~material. The ferromagnetic particles are particles of iron or iron alloys such as iron – silicon (Fe – Si), iron – aluminum (Fe - Al), iron - silicon– aluminum (Fe – Si – Al), iron – nickel (Fe – Ni), iron – cobalt (Fe – Co), iron – cobalt – nickel (Fe-Co-Ni), or the like, or combinations comprising at least one the foregoing iron alloys. In addition, the aforementioned alloys may comprise phosphorus and boron. While iron alloys generally have a higher permeability and lower core losses when compared with pure iron, pure iron provides a higher induction (high B), is softer, is easier to compact to high density and is lower in cost.

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Please replace paragraph [0066] with the following amended paragraph:

[0066] It is generally desirable for the ferromagnetic particles to have an average particle size as determined by the average mass radius of gyration of about 0.01 to about 25,000 micrometers (μm)~~ prior to coating and compaction~~. Within the aforementioned range for average particle sizes, it is desirable to have an average particle size of greater than or equal to about 0.1, preferably greater than or equal to about 1, and more preferably greater than or equal to about 10 μm. Also desirable within this range is a particle size of less than or equal to about 24,000, preferably less than or equal to about 23,000, and more preferably less than or equal to about 22,000 μm.

Please replace paragraph [0077] with the following amended paragraph:

[0077] The order of the annealing process and the cleaning process are reversible, i.e., either process may be carried out first as desired. In one exemplary embodiment, ~~when high aspect ratio particles are used, ~~the particles are first annealed to a temperature of 800°C for a period of about 30 minutes to about 90 minutes.

Please replace paragraph [0079] with the following amended paragraph:

[0079] The coating preferably permits adjacent particles to bind together with sufficient force that a part made by compacting the ferromagnetic particles has sufficient transverse rupture strength so that good mechanical properties can be achieved via compaction without any simultaneous or subsequent sintering after compaction. As used above, "sufficient transverse rupture strength" should be construed as meaning a transverse rupture strength of about 8 kilo pounds per square inch (kpsi) to about 20 kpsi, and preferably at least about 15 kpsi as determined in accordance with the protocol of the American Society of Test Materials (ASTM) MPIF Standard 41.

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Please replace paragraph [0087] with the following amended paragraph:

[0087] The articles derived by the aforementioned processes display a number of advantages. The coating provides an electrical insulation for individual ferromagnetic particles to reduce eddy current losses and may also serve as a binder or a lubricant. The desired properties in magnetic core articles made using ~~magnetite~~ coated ferromagnetic powders include high density, high permeability, low core losses, and high transverse rupture strength~~, and suitability for compaction techniques~~. The properties of magnetic core articles, made using magnetite coatings provide significant advantages particularly at ~~low~~ high frequency operation where low-core losses are particularly advantageous. Annealing the magnetic core article can result in increased permeability and lower core losses. Annealing relieves residual stresses caused by compaction of the encapsulated ferromagnetic powders. In addition, articles derived in this manner have a high copper fill factor and the air column is eliminated.

Please replace paragraph [0090] with the following amended paragraph:

[0090] The following example was conducted to determine the ability of the magnet wire to withstand the pressures developed during compaction.

Please replace paragraph [0091] with the following amended paragraph:

[0091] All the magnet~~ic~~ wires were characterized for (i) insulation thickness, (ii) windability, (iii) breakdown voltage / strength, (iv) compressibility and (v) thermal withstand capability. The measurement method/s adopted are detailed below.

Please replace paragraph [0095] with the following amended paragraph:

[0095] Compressibility: In this test, 15cm long test wire was placed in the cavity of a die and filled with ~~iron powder (particulates)~~ a soft magnetic composite. AC voltage of 200~~volts~~ V was applied between the die and the copper (one of the wire edge). The pressure was then applied through the top punch of the die up to 130 ksi (896 MPa). Any insulation failure, during the application of pressure, was detectable through electrical breakdown. The pressure at which the insulation failure was recorded. The values reported in the report correspond to a minimum of 6 data.

Please replace paragraph [0096] with the following amended paragraph:

[0096] The various samples tested are shown in Table 1 below. VonRoll Isola (VRI), Pearl, Doorvani, Showa were manufacturers of the respective samples shown in the table. The glass-based wires (as represented by samples 1 to 9 in Table 2) are prepared by wrapping the glass yarns on bare copper wire and bonded by using silicone resin. Single, double and triple (Samples 3 to 6) represent the number of glass layers provided on the wire. The difference between the wires 4 and 6 is the viscosity of the silicone resin. In the case of Sample 7, polyesterimide resin is used for bonding instead of silicone resin. The wires such as Sample 8 and 9 are prepared similar to that of the above wires; but the base wire is polyamideimide (PAI) enameled wire instead of bare copper wire. The enamel group wires (Samples 10 to 12) are prepared using enamel coating; but in the case of Samples 11 and 12 two layers of different enamel (PEI and PAI) coatings were applied. The wires (Samples 15 and 16) are coated with fluoropolymers such as polytetrafluoroethylene (PTFE) and ethylene tetrafluoroethylene (ETFE), respectively. Besides, the wrapped wires (Samples 13, 14 and 19 to 22) are made of wrapping the insulating paper / film such as Kapton, Mica and Mica-glass. In the case of Mica based film wrapped wires, thin insulating films such as Kapton, polyethylene (PE) or polyethylene terephthalate (PET) films are used for backing. The properties of all the wires are compared in the Table 1. It may be seen that the high temperature wire such as ceramic coated wire displays poor performance compared to other wires. The enamel

wire (PEI+PAI) could withstand compressibility only up to 80 kilo~~grams~~ pounds per square inch (ksi) (551.2 MPa) against the target value of 130 ksi (896 MPa).

Please replace paragraph [0097] with the following amended paragraph:

[0097] Following the results from Table ~~2~~1, several selected magnet wires are subjected to compression at 130 ksi (896 MPa) in ~~SMC powder~~soft magnetic composite (except enamel wire) followed by heat treatment in nitrogen at elevated temperatures. The breakdown values of the selected wires at different temperatures (after compression) are included in Table 2 below. ~~From Table 2 it may be seen that the performance of the wires such as Samples 3, 4 and 5 are found to be good at elevated temperatures.~~ Breakdown voltages are shown in kilovolts.

Please replace paragraph [0098] with the following amended paragraph:

[0098] The electrical ~~break-down~~breakdown characteristics of the selected magnet wires from Table 2 as a function of temperature are shown in Figures 3(a) and 3 (b), and indicates that fused glass wire (Figure 3(a))is suitable for temperatures up to 500°C where as the PEI-PAI enameled wire is suitable for temperatures up to 400°C (Figures 3(b)). As can be seen from the graph that the breakdown voltages of these wires are found to reduce significantly above the respective withstand temperatures.

Please replace paragraph [0100] with the following amended paragraph:

[0100] As in the case of magnet wire the major properties of ground wall insulation required for the present application are (i) high temperature withstand capability and (ii) the compressibility in the ~~SMC medium~~soft magnetic composite. Several insulation tapes were identified for the preliminary testing and screening as shown in Table 3. The mica tapes (Samples1 and 2) are made of muscovite mica paper backed with glass cloth. Silicon resin is used as the binder for making these tapes. In the case of Sample 3, the muscovite mica paper is backed with Kapton film (instead of glass cloth) as in the case of

Samples 1 and 2. Similarly, the Sample 6 is made of phlogopite mica paper backed with glass cloth. The Samples 4 and 5 are prepared by sandwiching the glass cloth backed muscovite mica paper between two thin papers / films of Nomex or Mylar. The Sample 7, based on ~~flouro~~ fluoro (Teflon) polymer is found to exhibit good mechanical properties (e.g., tear resistance). The breakdown voltage of the all the tapes is measured for as-received condition and also after exposing the tapes to higher temperatures in nitrogen for ~~30minutes~~thirty minutes. Table 3 below summarizes the results of various tapes that are evaluated.

Please replace paragraph [0101] with the following amended paragraph:

[0101] From ~~the~~ Table 3, it is seen that the ~~Kapton~~ KAPTON® backed (Sample3) and Mylar film- (Sample 5) and Nomex paper- (Sample 4) sandwiched mica tape displays better performance compared to other mica tapes. The Nomex sandwiched mica sheet (Sample 4) displayed, however, poor flexibility. The flexibility of the tapes is qualitatively judged by wrapping over a bundle of magnet wire. Poor flexibility results in the formation of the gaps between each layer, which is detrimental since the ~~SMG material~~soft magnetic composite can penetrate through the gaps. ~~Kapton~~KAPTON®-backed tape (Sample 3) displayed de-lamination at low temperatures (less than or equal to about 300°C) as well as poor compression strength in ~~SMG medium~~soft magnetic composite. However, Mylar sandwiched mica tape is found to display high flexibility and adequate breakdown voltage after the exposure to higher temperature (600°C). Similarly, the fluoro tape is found exhibit very high flexibility and superior breakdown properties up to 400°C despite its low thickness (1.38 mils). However, the compressibility of the flouro tape was found to be very poor. The superior properties such as lower thickness, higher breakdown voltage and high temperature withstand capability (400°C) makes the flouro tape suitable for the motors used at low temperatures. Similarly, Nomax sandwiched mica sheet is useful for the slot insulation / liner application in the conventional motors. Based on the above results, mylar film sandwiched mica glass (referred to as Isomica) may be used at elevated temperatures.

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Please replace paragraph [0103] with the following amended paragraph:

[0103] The bobbin (wrapped with ground wall insulation tape) was placed in an appropriate die cavity and filled with ~~SMC particulates~~soft magnetic composite. The bobbin was then subjected to compression by applying the pressure on the top punch of the die. The compressed sample was then ejected from the die and subjected to simple electrical tests: (i) continuity test between the two edges of the magnet wire (i.e., bobbin) and (ii) continuity test between the surface of the compressed bobbin (i.e., ~~SMC~~soft magnetic composite) and the magnet wire of the bobbin (copper). In the former test, any open circuit indicates the magnet wire damage, whereas in the latter test, the continuity indicates the damage of bobbin insulation (ground wall and magnet wire insulation).

Please replace paragraph [0105] with the following amended paragraph:

[0105] The selected magnet wires (fused glass and PEI-PAI enameled) and the Mylar sandwiched mica-glass tapes were subjected to evaluation in bobbin form. The wound coil is then wrapped with Isomica tape and the wrapping is performed with 50% overlap. The bobbin is then subjected to curing at 130°C in air for 2 hours. The cured bobbin is then placed in the die, followed by ~~SMC power (iron powder) filling~~soft magnetic composite and subjected to compression at about100 ksi (689 MPa) pressure. No visual damage is observed on the bobbin. The breakdown voltage of the ground wall insulation tape (i.e., wrapped on the bobbin), before and after compression in the ~~SMC powder~~soft magnetic composite is shown in Table 4 below:

Please replace paragraphs [0106] and [0107] with the following amended paragraphs:

[0106] The results indicate that the ground wall insulation survives under compression in the ~~SMC powder medium~~soft magnetic composite. The reduction in the BDV after compression is believed to be due to the edge effect where the pressure is believed to be very high due to non-uniformity. The cross section of the bobbin after compression in the ~~SMC powder~~soft magnetic composite is evaluated using scanning electron microscope. The compressed samples are cut using diamond blade (ISOMET). Typical cross section of the compressed bobbin is shown in Figure 4.

[0107] The micrographs of the bobbin cross section clearly indicates the ground wall insulation and magnet wire insulations are intact after compression in ~~SMC powder~~soft magnetic composite and heat treatment. The magnetic properties such as permeability and core loss were found to be very much improved in the SMC materials made with flake articles as compared to iron powder particles. Hence, the compression of bobbin in ~~SMC flake medium~~soft magnetic composite is also evaluated. As a first step, the selected magnet wire is been tested for the compressibility under flake medium. Figure 5 shows the effect of flake compression (100 ksi (or 689 MPa)) on the fused glass magnet wire. It may be seen that the insulation is damaged significantly. Similar tests were conducted on several types of magnet wires, and in all the cases the insulation was damaged significantly. This result clearly indicates that the insulation may not survive compression in ~~SMC flakes~~soft magnetic composite.

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Please replace paragraphs [0108], [0109] and [0110] with the following amended paragraphs:

[0108] This example was undertaken to determine whether the application of a coating to the ground wall insulation tape would enhance the ability of the insulation layer 20 to resist damage during the compaction of the ferromagnetic particles. A SILOX® CE77 coating, commercially available from Nippon Pelnox was evaluated in order to evaluate the flake-mitigation capability of the coating. Preliminary trials were conducted on the bobbins (without any ground wall insulation). The cross section of the bobbin subjected to 100 ksi (689 MPa) pressure when surrounded by ~~iron flakes~~soft magnetic composite, indicates that the coating resists the flake penetration. The magnet wire is found to retain the continuity and the insulation strength.

[0109] Three types of SILOX® coating material were evaluated. The basic formulation of the three grades was the same. The variables among these grades are (i) filler particle size distribution and (ii) the pigment. In order to understand the thermal withstand capability, different SILOX® materials made of 1mm thick plate were subjected to heat treatment in N_2 for 30min. at different temperatures. After cooling the samples, the breakdown voltages are determined. Figure 6 shows the breakdown voltages of different SILOX® grades as a function of heat treatment temperature. It may be seen from the Figure 6 that the grade-A (identified based on the red color pigment) exhibits higher BDV compared to other two grades. ~~Hence, grade A SILOX material was chosen for further evaluation. In order to understand the superior performance of grade A the comparative study was extended to the bobbin.~~ The bobbin samples with SILOX® coating were tested for BDV as shown in the Table 5 below.

[0110] The bobbins consisting of fused glass wire, mica tape and coated with a layer of SILOX® were then subjected to a compressibility (compaction) test when surrounded by ferromagnetic flakes. The breakdown voltage (BDV) as a function of pressure, shown in Figure 7, indicates clearly that the insulation is damaged at a very low pressure of 20 ksi (138 MPa). The BDV of the bobbin, however, without SILOX® coating displays higher BDV at 110 ksi (758 MPa) while being compacted in the ~~SMG powder (ferromagnetic~~

~~particles)~~ soft magnetic composite. ~~In order to understand the failure of insulation in flake medium, the~~The samples were subjected to cross sectional analysis from which it was determined that the bobbin was deformed significantly though the magnet wires are bundled together by ground wall tape and SILOX® coating. The deformation essentially results in sliding/pushing of SILOX® coating towards center. The optical micrograph of the sample shown in Figure 8 indicates that there is no damage to the magnet wire insulation. However, the thickness of the ground wall insulation is found to be non-uniform as evidenced in Figure 8. The reduced and non-uniform ground wall insulation thickness indicates that the deformation of bobbin is the major cause for the lower breakdown voltage, observed after the bobbin compression in flake medium. ~~In order to understand the insulation damages, after SMC flake~~After soft magnetic composite compression, the bobbin is separated from the flakes for analysis. The analysis confirmed that ground wall insulation was damaged significantly. Besides, the magnet wires are also found to be damaged particularly at the ends. The damaged location of the bobbin is closer to the die wall during compression. The combination of the non-uniform pressure in the die and the bobbin deformation is found to be responsible for the insulation damages. ~~In order to understand the deformation, a~~A set of bobbin is subjected to deformation and elongation analysis. The deformation of the bobbin is estimated from the width of the bobbin using the following ~~relation ship~~relationship:

Please replace paragraphs [0112], [0113], [0114] and [0115] with the following amended paragraphs:

[0112] The results of the deformation and elongation can be seen in the Figure 9. As can be seen in the graph, ~~that~~ the deformation percentage increases with the increase of pressure. The extent of deformation i.e., about 25%, observed at 110 ksi (758 MPa) pressure, is believed to be high. Contrarily, the deformation of the bobbin in ~~ferromagnetic particulate medium~~soft magnetic composite is about 10% at 110 ksi (758 MPa) pressure. The extent of elongation is found to be above 5% at the lower compaction pressure of 20 ksi (138 MPa). The breakage elongation percentage of the ground wall insulation tape as reported by the tape manufacturer (VRI) is about 5%. Based on the elongation behavior of the bobbin in flake compression and the breakage

elongation percentage of the insulation tape, it was concluded that the insulation tape is damaged at compaction pressures above 20 ksi (138 MPa).

[0113] ~~Cause-and-effect~~An analysis was performed in relation to the bobbin deformation. The analysis revealed that the bobbin deformation are potentially caused by the major factors such as (a) flake flowability (b) SILOX® coating thickness, (c) mechanical strength of insulation tape and (d) bobbin clearance from die wall. In order to understand the effect of each cause on the bobbin deformation was studied individually. The bobbin samples for these studies were prepared by using fused glass wire, Isomica tape and SILOX® coating as detailed above.

[0114] Based on the results detailed above the sample shape and process methods, die modification and compaction methodology were altered to establish a good method for evaluation and screening the insulation layer. Various parameters were evaluated such as (i) bobbin clearance (ii) flake flowability (iii) SILOX® coating thickness (iv) tape strength (v) method of compaction. For these experiments bobbins (wires from the winding) having a cylindrical shape were used. The insulation tape was wrapped over the bobbin and subjected to SILOX® coating as before. The samples thus prepared were subjected to compression in the presence of ~~ferromagnetic particulates (flake medium)~~ soft magnetic composite.

[0115] In order to reduce damage to the ~~ferromagnetic particulates~~soft magnetic composite that are in the form of flakes, a silicone lubricant was used to improve the flowability of the particulates.

Please replace paragraph [0117] with the following amended paragraph:

[0117] The bobbins possessing various SILOX® coating thicknesses disposed upon the ground wall insulation were subjected to compression in the presence of the flakes. In general it was observed that those samples with 0.5mm or less coating thickness displayed better results compared with those having a higher coating thickness. About 50% of the samples coated with SILOX® coatings having 0.5 mm thickness were found to exhibit BDV around 1.5kV. In the case of higher coating thickness (greater than or

equal to about 0.5mm thick) more than 90% of the samples failed during compression. The BDV of about 1.5 kV observed with thickness 0.5mm or less is, however, not adequate as the BDV target is more than 2 kV.

Please replace paragraph [0119] with the following amended paragraph:

[0119] The bobbin samples with different insulation tapes were prepared as discussed in the above example. The SILOX coating thickness in all the samples are 0.5mm thickness and the only variable is the type of insulation tape. The samples thus prepared are subjected to compression in the flake medium at 110 ksi (758 MPa) pressure. ~~From Table 6, it may be seen that only around 50% of the samples survived (i.e., they displayed no shorting or discontinuity in the magnet wire) after the compression.~~ In the case of myoflex-taped samples, the overlap portions of tape were damaged significantly. The BDV characteristics of selected type of samples are compared in the Weibull plot shown in Figure 10. The SILOX® coating thickness effect on the breakdown voltage of bobbin (without any tape) is also shown in Figure 10. It may be seen from the Weibull plot that the BDV of the samples are less than or equal to about 1 kV~~, which is not acceptable for the present application~~. However, Isomica taped bobbin displays the highest BDV among all the tapes studied.

Please replace paragraph [0121] with the following amended paragraph:

[0121] Similar experiments/tests were conducted for SMC powders and shorter flake having a length of 5 mm to understand the pre-compaction pressure effect on the final BDV characteristics. Interestingly, in all the cases, the samples were subjected to a pre-compaction pressure of 90 ksi displayed higher breakdown voltage as summarized in Table 7. Note that the BDV of the samples compressed in powder and 5 mm flake displays are closer to each other (i.e., the BDV is greater than or equal to about 3 kV), whereas the samples compressed with longer flakes (10.5 mm) displays lower BDV. The observed results clearly indicate that the flowability of the ~~SMC medium~~soft magnetic composite is the major factor that controls the BDV. Keeping this view in mind, the effect of flake mixture on the BDV is studied to optimize the compaction methodology.

Please replace paragraph [0123] with the following amended paragraph:

[0123] The responses studied for the DOE are breakdown voltage and deformation. The insulation system studied in the DOE is the combination of (i) fused glass magnet wire, (ii) Isomica tape as ground wall insulation and (iii) SILOX® coating for mitigation of flake penetration. Bobbins prepared with this insulation system were used for the flake mixture study. The first DOE-response, i.e., breakdown voltage, is estimated for all the combination and plotted in Figure12. Figure 12 shows that the breakdown voltage increases as the flake size reduces. The magnetic properties such as permeability are found to increase with the flake size. Hence, using the DOE, an optimum flake mixture is obtained using the following constraints: (i) 10.5mm flake – minimum of 25 wt% and (ii) breakdown voltage greater than or equal to about 3000 volts. Under these constraints, the optimum flake mixture is obtained through the DOE tool is as follows: 3 mm flakes present in an amount of 72 wt% and 10.5 mm flakes present in an amount of 28wt%. The optimum flake mixture was tested under the same conditions as detailed above and displayed that the BDV of the bobbin is above 3kV. The second response - deformation is also studied. The second response (i.e., deformation) of the flake mixture DOE is also studied. The deformation of the bobbins is estimated as A/B ratio from A and B as indicated in the micrograph shown in Figure 13. The DOE plot for the deformation is shown in the Figure 14. Note that zero deformation corresponds to the ratio (A/B) of 1. Hence, lower the ratio higher the deformation. Figure 14 reveals that the deformation ratio, observed within the range, does not show any predictable trend. From these experiments it can be seen that all the samples passed (i.e., no shorting or discontinuity in magnet wire observed) during with a two-stage compression; but the BDV values vary depending upon the length of flakes. The 3 millimeter flakes show a higher BDV than the other larger size flakes.

Please replace paragraph [0124] with the following amended paragraph:

[0124] Since the insulation is found to survive during two-stage compaction in ~~SMC flake medium~~soft magnetic composite a set of bobbins was prepared for a thorough analysis under alternating current (AC) and impulse conditions. ~~This part of study was aimed at understanding the inter-turn insulation and ground wall insulation under compression followed by heat treatment in N_2.~~ The bobbins are prepared by using two separate magnet wires for winding. This was done primarily to have the terminals for the measurement of inter-turn insulation. The schematic diagram of the bobbins is depicted in Figure 15 and shows the terminals used for the electrical measurements. Four types of bobbins, (i) fused glass wire (having 3.8 and 3.0 mil thick insulation) and (ii) PEI_PAI enameled wire (1.6 and 0.8 mil thick insulation) were prepared for the electrical study. The ground wall insulation tape used in all the case was Isomica (VRI) tape. After wrapping ground wall tape (50% overlap and 2 layers) the bobbins were coated with SILOX® (0.5mm thick) and subjected to curing as discussed before. The samples thus prepared were subjected to two stage compression (a) pre-compression – 90 ksi and (b) final compression – 110 ksi) in ~~SMC flake medium~~soft magnetic composite (3mm length). Subsequently, the compressed samples were subjected to heat treatment in N_2 at various temperatures up to 500°C for fused glass wire and 350°C for PEI-PAI enameled wire. Initially, all the samples were subjected to screening tests as below:

(i) Inter-turn insulation: 50HZ AC up to 200 V

(ii) Ground wall insulation: Impulse (1.2/50 μs) up to 6000 V

Please replace paragraphs [0126], [0127] and [0128] with the following amended paragraphs:

[0126] Similarly, the wires could withstand the power frequency voltage of 200 volts (minimum)~~-indicating that these wires are suitable for the SMC molded motor applications~~. The ground wall insulation of the bobbins made of fused glass wires (3 and 3.8 mil insulation thickness) was also tested under impulse and power frequency voltages. Figure 17 shows the ground wall insulation breakdown strength of the bobbin as a function of heat treatment temperature, after compression at 110 ksi in 3mm flake

medium. Figure 17 reveals that the ground wall insulation (Isomica tape + SILOX® coating) could withstand voltages of greater than or equal to about 3kV (impulse) and greater than or equal to about 2 kV (AC) up to 500°C, indicating that the ground wall insulation survives under compression in flakes (3 mm) and heat treatment up to 500°C.

[0127] The bobbins that are prepared with PEI-PAI enamel wires of 1.6 and 0.8 mil insulation thickness and the ground insulation of Isomica tape and SILOX® coating were also subjected to compression at 110 ksi and heat treatment at different elevated temperatures up to 350°C. These samples were subsequently evaluated for the breakdown voltages of inter-turn insulation and ground wall insulation as in the case of fused glass wire. Figure 18 shows the breakdown strength of the inter-turn insulation as a function of heat treatment temperature. Figure 18 reveals that the BDV of the inter-turn insulation (PEI-PAI) is above 1.5 kV (Impulse) and 200 V AC (minimum) up to 400°C. The electrical withstand level of the enamel wire (Figure 18) is adequate for the present application.

[0128] The BDV of the ground wall insulation (Isomica tape + SILOX® coating), of the bobbins made of enamel wires (PEI-PAI) were also evaluated for the electrical breakdown under power frequency and impulse conditions. The breakdown voltages of the ground wall insulation as a function of heat treatment temperature is shown in Figure 19. Note that the breakdown voltage of ground wall insulation is around 4 kV (AC) and greater than or equal to about 5 kV (impulse) up to the heat treatment temperature of 400°C (Figure 19). ~~The BDV levels observed in the ground wall insulation are adequate for the SMC molded motor applications.~~ Based on the electrical breakdown characteristics of the inter-turn and ground wall insulation results, the following insulation system is recommended:

(a) Fused glass wire (3mil thick): Temperature up to 500°C and compression up to 110 ksi
(b) PEI-PAI wire (0.8 mil thick): Temperature up to 400°C and compression up to 110 ksi.

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Please replace paragraphs [0131], [0132] and [0133] with the following amended paragraphs:

[0131] In order to determine a more advantageous method of compaction (than the two stage compaction process) that will not damage the insulation, an attempt was made to understand the effect of axial compaction where the bobbin position is parallel to the direction in which the compaction force is applied. During compaction, the ~~SMC medium~~soft magnetic composite is expected to flow along the surface (axial direction) of the bobbin. The number of turns of each bobbin is about 15 turns. The preliminary compaction (i.e., axial) was performed with the different ~~SMC mediums~~soft magnetic composites such as powder and flakes (3 and 10.5 mm long respectively). The compression is performed at 100 ksi pressure in all the cases. After compression, each cavity bobbin is subjected breakdown tests under AC. Interestingly, all the 4 cavity bobbins survived (i.e., no shorting or discontinuity in the magnet wire) under axial compaction in ~~SMC medium~~soft magnetic composite including 10.5mm flakes. ~~These preliminary results indicate that the axial compression may be a potential technique for the SMC molded motor manufacturing.~~ The AC breakdown voltages of the above axial-compacted samples are compared in Table 8.

[0132] It may be seen (Table 8) that the bobbins compressed (axial) in ~~SMC powder~~soft magnetic composite and 3 mm flakes display higher BDV (average) compared to that of 10.5 flakes. The observed trend is consistent with that observed in the samples compacted with the conventional die (i.e., compaction in the radial direction). In the case of 3mm flake compression, the samples without SILOX® coating results in very low BDV compared to that observed with SILOX® coating. These results substantiate the fact that the SILOX® coating plays an important role in the insulation protection. ~~The significant variation in the BDV among the bobbins of 4 cavities (i.e., for a single compaction) may be attributed to the non uniform flow of SMC material / stress during compaction. Hence, the die design and bobbin preparation requires appropriate modification to attain uniform results among the bobbins.~~

[0133] Based upon the aforementioned results it may be seen that fused glass wire insulation may be used advantageously for temperature up to 500°C and PEI-PAI enameled wire up to 400°C. The insulation thickness of the former is about 3 mil (75 micrometers) and for the latter it is 1mil (25 micrometers) is found to withstand the compression and high temperature. High copper fill factor is achievable in the case of enameled wire due to the fact that (i) the insulation thickness is lower and (ii) compaction results in hexagonal structure formation. Isomica tape (glass backed mica – sandwiched between mylar films) displays good performance under compression and at high temperatures. Use of SILOX® like material coating plays vital role in mitigating the flake penetration and hence such coating is recommend for protecting the ground wall insulation such as Isomica tape. ~~Axial compaction appears to be a potential technique for the manufacturing of SMC molded motors and advantageously shows a higher breakdown voltage after compaction.~~

Please delete paragraph [0065] on page 17 and paragraph [0070] on pages 18 and 19 respectively.

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Please substitute Table 1 with the following amended Table 1:

Sample number	Insul. thick (mils)	Breakdown strength (Volts/mil)	Winding NEMA-MW1000	Compressibility (ksi)
1. Glass: Fused (VRI)	3.8	225 ± 0.13	1d	✓ 130
2. Glass: Fused (VRI) – thin Insulation	3.0	253± 16	1d	✓ 130
3. Glass: Silicone bond-single (Pearl)	3.2	236± 12	1d	106± 30 *(fail)*
4. Glass: Silicone bond-double-A (Pearl)	3.9	172 ± 5	1d	90± 7 (fail)
5. Glass: Silicon bond-Triple (Pearl)	6.93	268± 16	1d	✓ 130
6. Glass: Silicone bond-double-B (Pearl)	4.65	456± 56	1d	✓ 130
7. Glass: PEI bond-single (VRI)	2.9	224± 5.7	1d	15± 4 (fail)
8. Glass – 2L+Enamel: Silicone bond *(Pearl)*	5.2	1000± 14	1d	✓ 130
9. Glass – 1L+Enamel: Silicone bond *(Pearl)*	3.7	1465± 23	1d	✓ 130
10. Enamel: Dual PEI + PAI (Pearl)	1.6	3450± 65	1d	82± 29 *(fail)*
11. Enamel: Dual PEI + PAI (Pearl) - thin	0.79	2145± 45	1d	71± 22 *(fail)*
12. Enamel: PAI (Pearl)	1.55	1138± 58	1d	88± 12 *(fail)*
13. ~~Kapton~~KAPTON®: 75% overlap (Pearl)	4.6	>2150	1d	✓ 100
14. ~~Kapton~~KAPTON®: 50% overlap (Pearl)	2.9	2469± 39	1d	60± 4 *(fail)*
15. PTFE: coated (Doorvani)	2.99	2074± 53	1d	22± 4 *(fail)*
16. ETFE: coated (Doorvani)	6.61	>1513	1d	105± 17 *(fail)*
17. Ceramic: Coated (Showa)	7.1	178± 13	5d	10± 0.5 *(fail)*
18. Mica-Glass (VRI)	3.1	210± 6	2d	✓ 130
19. Semica taped + PE film (VRI)	4.9	87± 6	2.5d	< 50 *(fail)*
20. Semica taped + Kapton film (VRI)	4.5	402± 18	3d	60 ± 15 *(fail)*
21. Mica-Glass: Cablosam-SF650 (VRI)	3.87	143± 8	5d	30 ± 10 *(fail)*
22. Mica-Glass: Cablosam-SF450/PET (VRI)	4.97	453± 11	5d	50 ± 10 *(fail)*

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Please replace Table 3 with the following amended Table 3:

Sample Number	Thick. (mil)	BDV/mil (kV/mil)	BDV-kV (30°C)	BDV-kV 600°C
1. Mica Tape: glass backed (VRI)	4.82± 0.13	0.44± 0.06	2.1± 0.05	1.68± 0.11
2. Mica Tape: glass backed (L.Isola)	4.86± 0.11	0.37± 0.03	1.8± 0.04	1.57± 0.07
3. Mica Tape: ~~Kapton~~ KAPTON® backed (L.Isola)	5.93± 0.12	1.28± 0.04	6.8± 0.2	4.3± 0.13
4. Nomex-Mica-Nomex Sheet (VRI)	3.73± 0.45	1.21± 0.04	4.5± 0.15	3.5± 0.15
5. Mylar-Mica-Mylar tape (VRI)	5.91± 0.14	1.01± 0.05	6.1± 0.1	2.8± 0.07
6. Phlogopite Mica tape (Crystal Land)	4.86± 0.1	0.34± 0.04	1.65± 0.1	1.5± 0.1
7. Fluoro Tape (W. L. Gore)	1.38± 0.05	3.60± 0.15	4.97± 0.2	5.73± 0.2 *

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Please replace Table 5 with the following amended Table 5.

Coating Grade	BDV (kV)
~~Silox~~ SILOX® A	2.0±0.10
~~Silox~~ SILOX® B	1.5±0.21
~~Silox~~ SILOX® C	1.4±0.11

Please replace Table 7 with the following amended Table 7.

~~SMC particles~~ Soft Magnetic Composite	Average breakdown voltage (kV)
Powder	3.47
Flake (10.5 mm)	1.73
Flake (5 mm)	3.05

Please replace Table 8 with the following amended Table 8.

S. No.	Sample	Avg.
1	Powder: No SILOX® ~~silox~~	3.3
2	Powder: No SILOX® ~~silox~~	2.3
3	3 mm flake: No SILOX® ~~silox~~	1.18
4	3 mm flake: SILOX® ~~silox~~	3.23
5	3 mm flake: SILOX® ~~silox~~	2.93
6	10.5 mm flake: SILOX® ~~silox~~	2.28
7	10.5 mm flake: SILOX® ~~silox~~	2.03